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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/096,858	06/12/98	NARWANKAR	P AMAT2571.057

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EXAMINER

MAI, A

ART UNIT PAPER NUMBER

2814

DATE MAILED: 05/02/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Applicant(s) N .

09/096,858

Applicant(s)

NARWANKAR ET AL.

Examiner

Anh D. Mai

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 April 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-45 is/are pending in the application.
- 4a) Of the above claim(s) 33-45 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: _____

DETAILED ACTION

Continued Prosecution Application

1. The request filed on April 6, 2001 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/096,858 is acceptable and a CPA has been established. An action on the CPA follows.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 24-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 24 recites the limitation "said first chamber" and "said second chamber" in lines 11 and 14, respectively. There is insufficient antecedent basis for this limitation in the claim.

There are a deposition chamber, line 6, and a remote plasma generation chamber, line 9.

It is not known which of these chamber is the first or second chamber.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who

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has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims 1-7 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Gealy et al. (U.S. Patent No. 6,082,375).

Gealy teaches a method of annealing a dielectric layer as claimed including:

forming a dielectric layer on a substrate;

generating ionized atoms in a first chamber;

flowing the ionized atoms through a conduit coupling the first chamber to a second chamber, wherein the ionized atoms become electrically neutral active atomic species before reaching the second chamber; and

exposing the dielectric layer to the active atomic species in the second chamber.

With respect to claim 2, the active atomic species of Gealy comprises reactive oxygen atoms.

With respect to claim 3, the active atomic species of Gealy comprises reactive nitrogen atoms.

With respect to claim 4, the dielectric layer of Gealy comprises a metal-oxide.

With respect to claim 5, the dielectric layer of Gealy comprises transition metal dielectric.

With respect to claim 6, the dielectric layer of Gealy comprises Ta₂O₅.

With respect to claim 7, the dielectric layer of Gealy is exposed to the active atomic species while being heated to a temperature of less than 400 °C.

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4. Claims 8-12 are rejected under 35 U.S.C. 102(~~(b)~~) as being clearly anticipated by Gealy '375.

Gealy teaches a method of forming a dielectric layer as claimed including:

generating a plasma comprising ionized atoms in a first chamber;

flowing the ionized atoms through a conduit coupling the first chamber to a second chamber, wherein the ionized atoms become electrically neutral active atomic species before reaching the second chamber; and

depositing a dielectric layer onto a substrate by CVD in the second chamber and while depositing the dielectric layer, providing the active atomic species into the second chamber.

With respect to claim 9, the active atomic species of Gealy comprises reactive oxygen atoms.

With respect to claim 10, the dielectric layer of Gealy comprises a metal-oxide dielectric.

With respect to claim 11, the dielectric layer of Gealy comprises transition metal dielectric.

With respect to claim 12, the dielectric layer of Gealy comprises Ta₂O₅.

5. Claims 14-16, 18 and 21-23 are rejected under 35 U.S.C. 102(~~(b)~~) as being clearly anticipated by Gealy '375.

Gealy teaches a method of annealing a deposited oxide as claimed including:

locating a substrate in a first chamber, the substrate having a deposited oxide formed thereon;

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generating a plasma comprising ionized oxygen atoms in a second chamber;
flowing the ionized oxygen atoms from the second chamber into the first chamber
through a conduit wherein the ionized atoms become electrically neutral reactive oxygen atom
while flowing from the second chamber to the first chamber; and
exposing the deposited oxide to the reactive oxygen atom.

With respect to claim 15, the deposited oxide of Gealy is exposed to the reactive oxygen atoms while heating the substrate to at a temperature of less than 400 °C.

With respect to claim 16, the second chamber of Gealy is a microwave applicator cavity of a remote plasma generator and is well known in the art.

With respect to claim 18, the reactive oxygen atoms of Gealy is formed by generating plasma from N₂O molecule.

With respect to claim 21, the deposited oxide of Gealy comprises a metal-oxide.

With respect to claim 22, the deposited oxide of Gealy comprises transition metal oxide.

With respect to claim 23, the transition metal-oxide of Gealy comprises Ta₂O₅.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. Claims 24-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gealy '375 in view of Hasegawa '015.

Gealy teaches a method of forming capacitor substantially as claimed including:
depositing a transition metal dielectric on the substrate in a deposition chamber;
generating a plasma comprising ionized oxygen atoms by forming the plasma from an oxygen-containing gas in a microwave applicator cavity in a remote plasma generator chamber;
flowing the ionized oxygen atoms through a conduit coupling the first chamber to a second chamber, wherein the ionized atoms become electrically neutral reactive oxygen atoms before reaching the second chamber; and
annealing the transition metal dielectric in the second chamber by exposing the transition metal dielectric to the reactive oxygen atoms.

Thus, Gealy teaches all of the features of the claim with the exception of detailing the structure of the well known stacked capacitor.

However, Hasegawa teaches forming a stacked capacitor including:

forming a bottom electrode (20);
forming a transition metal dielectric (22) on the bottom electrode; and
forming top electrode (24) above the transition metal dielectric. (See Fig. 1).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the stacked capacitor of Gealy as taught by Hasegawa to complete the memory device.

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With respect to claims 25-27 and 29, the transition metal dielectric of Hasegawa is Ta_2O_5 , deposited by CVD utilizing a source gas comprising TAETO, TAT-DMAE, O_2 and N_2O .

With respect to claim 28, the transition metal dielectric of Gealy is deposited at a temperature between 300-500 °C.

With respect to claim 30, the transition metal dielectric film of Gealy is annealed in the deposition chamber.

With respect to claim 31, the transition metal dielectric of Gealy is annealed at a temperature of less than 400 °C.

7. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gealy '375 and Hasegawa '015, as applied to claim 24 above, and further in view of Nishiki '782.

Gealy and Hasegawa teach all of the features of the claim with the exception of anneal the transition metal dielectric in a chamber other than the deposition chamber.

Nishiki teaches using a multi-chamber processing tool wherein annealing is conducted in a chamber other than the film deposition chamber. (See col. 6, ll. 3-7).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to anneal the transition metal dielectric of Gealy in a chamber other than the deposition chamber as taught by Nishiki to avoid reacting the transition metal dielectric with the ambient in the deposition chamber, specially carbon atoms, thus deterioration of the transition metal dielectric is eliminated.

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8. Claims 13 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gealy '375, as applied to claims 8 and 14 above, and further in view Toshio (JP 04092423).

Gealy teaches all of the features of the claim with the exception of using silicon-oxide as the dielectric layer.

However, Toshio teaches oxygen radical is also used to passivate the surface a silicon-oxide layer.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the dielectric layer of Gealy comprising silicon-oxide as taught by Toshio because the reactive oxygen atoms can be used to oxidize the surface of the silicon oxide as well. Moreover, silicon oxide is a known capacitor dielectric.

9. Claims 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gealy '375, as applied to claim 14 above, and further in view Hasegawa '015.

With respect to claim 17, Gealy teaches all of the features of the claim with the exception of forming the reactive oxygen atoms using O₂ molecules.

However, Hasegawa teaches that oxygen is a well known molecule utilizing to generate reactive oxygen atoms.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form reactive oxygen atoms of Gealy utilizing O₂ as taught by Hasegawa to generate reactive oxygen atoms.

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With respect to claim 19, the reactive oxygen atoms of Gealy is generated utilizing microwaves.

Response to Arguments

10. Applicant's arguments with respect to claims 1-32 have been considered but are moot in view of the new ground(s) of rejection.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
April 27, 2001


Olik Chaudhuri
Supervisory Patent Examiner
Technology Center 2800